Amendments to the Claims

This listing of claims replaces all prior versions and listings of claims in this application.

1–17. (Cancelled)

18. (New) A cannula system comprising:

a steerable, rigidizable core;

an accessory lumen in the core;

an engagement feature that runs longitudinally along the outside of the core;

a first tool that extends through the accessory lumen; and

a second tool that slides along the engagement feature.

19. (New) A rigidizing mechanism comprising:

a first link, wherein the first link comprises a convex surface;

a second link, wherein the second link comprises a concave surface that receives the convex surface of the first link; and

a compression element that when activated compresses the concave surface of the second link against the convex surface of the first link with a force sufficient to prevent the first and second links from moving relative to one another.

20. (New) The rigidizing mechanism of claim 19:

wherein the convex surface of the first link and the concave surface of the second link comprise a ball and cup joint.

21. (New) A rigidizing mechanism comprising:

a first link, wherein the first link comprises a convex surface;

a second link, wherein the second link comprises a concave surface that receives the convex surface of the first link; and

an active material component positioned between the convex surface of the first link and the concave surface of the second link;

wherein in a first state the active material component interferes between the convex and concave surfaces with a force sufficient to prevent the first and second links from moving relative to one another, and in a second state the active material component does not significantly interfere between the convex and concave surfaces.

22. (New) The mechanism of claim 21:

wherein in the active material component comprises an electroactive polymer.

23. (New) The mechanism of claim 21:

wherein the active material component is energized and expanded radially in the first state.

24. (New) The mechanism of claim 21:

wherein the active material component is energized and contracted radially in the second state.

25. (New) The mechanism of claim 21:

wherein the convex surface of the first link and the concave surface of the second link comprise a ball and cup joint.

26. (New) A rigidizing mechanism comprising:

an inner element and an outer element positioned concentrically around the inner element, wherein the inner and outer elements are flexible; and

a plurality of components positioned between the inner and outer elements,

wherein in a first state the components interfere between the inner and outer elements with a force sufficient to prevent the inner and outer elements from moving relative to one another, and in a second state the components do not significantly interfere between the inner and outer elements.

27. (New) The mechanism of claim 26:

wherein the components comprise an electroactive polymer.

28. (New) The mechanism of claim 26:

wherein the components comprise balloons.

29. (New) The mechanism of claim 26:

wherein the components are energized and expanded radially in the first state.

30. (New) The mechanism of claim 26:

wherein the components are energized and contracted radially in the second state.

31. (New) A cannula system comprising:

a rigidizing structure, wherein the rigidizing structure is relaxed in a first state and stiffened in a second state; and

a passive element coupled parallel to the rigidizing structure, wherein the passive element is more rigid than the rigidizing structure's first state and more flexible than the rigidizing structure's second state.

32. (New) The cannula system of claim 31:

wherein the rigidizing structure is positioned concentrically within the passive element.

33. (New) The cannula system of claim 31:

wherein the passive element is positioned concentrically within the rigidizing structure.

34. (New) The cannula system of claim 31 further comprising:

a vibrating device coupled to the passive element;

wherein the vibrating device vibrates the passive element as the passive element is moved relative to the rigidizing structure in the second state.

35. (New) A cannula system comprising:

a core; and

a sheath positioned concentrically around the core;

wherein at least one of the core or the sheath comprises:

an inner tube;

an outer tube; and

a stiffening material between the inner tube and the outer tube, wherein the stiffening material changes viscosity when energized.

36. (New) The cannula system of claim 35:

wherein the viscosity of the stiffening material increases when the stiffening material is energized.

37. (New) The cannula system of claim 35:

wherein the viscosity of the stiffening material decreases when the stiffening material is energized.

38. (New) The cannula system of claim 35 further comprising:

a separating material between the inner tube and the outer tube;

wherein the separating material acts as a baffle for the stiffening material.

39. (New) The cannula system of claim 35:

wherein the stiffening material is selected from the group consisting of electrorheological fluid and magnetorheological fluid.

40. (New) A cannula system comprising:

a core;

a sheath positioned concentrically around the core;

a first heating element associated with the core, wherein the core is normally rigid and becomes flexible when the first heating element heats the core above a transition temperature that is above a normal body temperature; and

a second heating element associated with the sheath, wherein the sheath is normally rigid and becomes flexible when the second heating element heats the sheath above the transition temperature.

41. (New) The cannula system of claim 40:

wherein at least one of the sheath or core comprises a guidewire;

wherein the guidewire comprises wirewound coils potted in a low temperature flowing material;

wherein below the transition temperature the low temperature flowing material prevents the coils from moving substantially with respect to one another; and

wherein above the transition temperature the low temperature flowing material softens to allow relative motion between the coils.

42. (New) A cannula system comprising:

a core and a sheath positioned concentrically around the core, wherein at least one of the core or the sheath comprises a substantially stiff material that relaxes upon vibration; and

a vibrating element coupled to vibrate the substantially stiff material.

43. (New) The cannula system of claim 42:

wherein the substantially stiff material is selected from the group consisting of interlocking particles and normally-viscous fluid that becomes less viscous upon agitation.

44. (New) The cannula system of claim 42:

wherein at least one of the core or the sheath comprises a piezoelectric material along its length that acts as the vibrating element.

45. (New) A cannula system comprising:

a core and a sheath positioned concentrically around the core, wherein at least one of the core or the sheath comprises compression-stiffening particles; and

a vacuum or pressure source coupled to compress the compression-stiffening particles.

46. (New) The cannula system of claim 45:

wherein the core or sheath that comprises the compression-stiffening particles further comprises a compliant tube; and

wherein the vacuum source pulls a wall of the tube towards the compression-stiffening particles.

47. (New) The cannula system of claim 45:

wherein the core or sheath that comprises the compression-stiffening particles further comprises a compliant tube; and

wherein the pressure source pushes a wall of the tube towards the compression-stiffening particles.

48. (New) A cannula system comprising:

a plurality of articulating links;

a compliant cover positioned around the links; and

a pressure source coupled to expand the cover;

wherein in a first state the cover is sufficiently taut to keep the links from substantially moving relative to one another; and

wherein in a second state the cover receives pressure from the pressure source that is sufficient to allow the links to move relative to one another.

49. (New) A cannula system comprising:

a plurality of articulating links;

a compliant cover positioned around the links; and

a vacuum source coupled to compress the cover;

wherein in a first state the cover is sufficiently loose to allow the links to move relative to one another; and

wherein in a second state the cover receives a vacuum from the vacuum source that is sufficient to keep the links from substantially moving relative to one another.

50. (New) A linkage structure comprising:

a plurality of links;

wherein each link comprises a first end, a second end opposite the first end, and a longitudinal axis defined between the first and second ends;

wherein each link further comprises a curved concave slot at the first end and a curved convex tab at the second end, the slot and the tab being perpendicular to the longitudinal axis and orthogonal to one another, the slot receiving an adjacent curved convex tab and the tab inserting into an adjacent curved concave slot.

51. (New) A linkage structure comprising:

a plurality of serial links, wherein the distal end of the plurality of serial links comprises a steerable tip portion; and

a cable that wraps around a pulley positioned at the distal end of the steerable tip portion;

wherein tension on the cable stiffens the linkage structure by increasing friction between the links.

52. (New) The linkage structure of claim 51:

wherein the pulley comprises a rotating element.

53. (New) The linkage structure of claim 51:

wherein the pulley is positioned away from the central axis of the linkage structure.

54. (New) A cannula system comprising:

a rigidizing structure, wherein the rigidizing structure is relaxed in a first state and stiffened in a second state;

a passively flexible element slidably engaged in parallel with the rigidizing structure; and

a vibrating device coupled to the passive element;

wherein the vibrating device vibrates the passively flexible element as the passively flexible element is moved relative to the rigidizing structure in the second state.

55. (New) The cannula system of claim 54:

wherein the passively flexible element is positioned concentric to the rigidizing structure.